CASE STUDY—DRINKING WATER
ETV VERIFICATION AIDS A TECHNOLOGY BREAKTHROUGH

The public's concern about drinking water safety has accelerated as a result of a number of highly publicized outbreaks of waterborne diseases, such as the outbreak of cryptosporidiosis in Milwaukee in 1993. *Cryptosporidium parvum* is a protozoan parasite that causes severe gastrointestinal disorders in humans and other animals. Chlorination—the most common type of disinfection used to treat drinking water—is relatively ineffective against waterborne *C. parvum* when it forms an oocyst (i.e., the hard-shell stage of its life). Low-level ultraviolet radiation (UV) technology has been used for many years to kill disease-causing bacteria in wastewater treatment systems, but was assumed to be ineffective against waterborne pathogens with hard shells, such as the *C. parvum* oocyst.

Calgon Carbon Corporation (Ottawa, Canada), a world leader in water treatment technologies, developed the Sentinel™ UV system for secondary disinfection of drinking water and removal of *C. parvum* oocysts using low-level ultraviolet light. In this technology, the UV radiation causes photochemical reactions within a cell that disrupt the cell's ability to reproduce, thus removing the cell's ability to infect. Calgon recognized the challenges it faced related to market acceptance of this technology; that is, claiming that the Sentinel™ system could be an integral part of a larger disinfection process to remove pathogens such as *C. parvum* at low cost and with no (or very low) residual byproduct generation was expected to be met with market resistance. In part for this reason, the company applied for performance verification of its UV product in the Drinking Water Systems Pilot of the ETV Program, operated by NSF International, Ann Arbor, MI. The verification focused on the ability of the Sentinel™ system to inactivate *C. parvum* oocysts. The ETV test methods used a novel approach to evaluating UV disinfection by having laboratory mice ingest UV-treated oocysts and assessing whether the mice showed symptoms of cryptosporidiosis. The technology performed well in the ETV testing. Subsequent work by other researchers confirmed the ETV test data and led to serious consideration by EPA's Office of Ground Water and Drinking Water to allow use of UV in drinking water treatment for prevention of waterborne cryptosporidiosis. Furthermore, the ETV Program provided extensive exposure to UV treatment technology in a short period of time.

Although the verification testing was relatively expensive, according to Calgon the verification was well worth the investment because the drinking water industry would not have accepted UV disinfection without the third-party evaluation. In addition, the verification helped bring the Sentinel™ system and UV disinfection for drinking water as a concept to the forefront in the drinking water treatment marketplace.

Soon after verification, Calgon sold a 14 million gallon per day (mgd) UV disinfection unit to a group of hospitals in Grosse Pointe, MI, for use in eliminating parasites from drinking water, according to William LaVoice, Marketing Manager in Calgon's Engineered Solutions Group. Calgon is also expanding the Sentinel™ technology into the large water system market and has installed a UV disinfection system in Pittsburgh, PA, that treats 40 mgd. In 2001, Calgon sold a Sentinel™ UV disinfection unit that treats 95.1 mgd to a facility in Alberta, Canada—to date, this is the largest surface water UV reactor in the world. In October 2000, Calgon received a U.S. patent for *C. parvum* control in drinking water using UV radiation. As a result of the attention the Sentinel™ system received and its market success to date, several other companies have developed UV disinfection systems for drinking water and are now seeking ETV verification.